

The 50 MHz DX Bulletin

Volume 4

1993 April

Issue 4

The 50 MHz DX Bulletin was founded by Harry Schools KA3B. It is dedicated to the understanding and utilization of long distance propagation in the 6-meter Amateur band. This issue, edited and published by Victor Frank, K6FV, is the seventh and last "fill-in" issue and was actually written in November 1993. Subscription rates are \$20 U.S. third class mail, \$25 U.S./Canada/Mexico airmail, \$25 by surface or \$30 airmail elsewhere for 12 issues. Circulation matters and DX reports should be sent to 12450 Skyline Blvd., Woodside, CA 94062-4541 USA. If you can reach the Internet, my address there is frank@marie.sri.com. The Bulletin may be freely quoted, provided that credit is given.

Cosmic Noise?

Leif LA9ZV reported the following in the April 1993 issue of *Six News*:

"My 6m station is located on a hilltop with two good antennas looking out over the sea. There are no power or telephone lines up to my summer house. My radios are powered by generators and storage batteries. To sum up, the QTH is very quiet, apart from the occasional speed boat.

During the last two summers, I have noticed an increase in the receiver noise in some beam directions during the months of June, July, and August, when it peaks a few dB over the normal white noise. The noise is stronger on 50 than on 144 MHz. On 28 and 21 MHz, I am not sure if it is present due to too much man-made noise. The 50 MHz noise is always there, independent of band openings. The noise does not come from the sun, as it can be heard one to two hours after sunset. (We do not have midnight sun up at 59° N). Some VHFers suggest computers or fuel stations. I have no sources like that within miles and they hardly move by the clock anyway.

A local amateur, LA8PA (who has a PH.D. in Astrophysics) agrees that it could be galactic noise, and if so, it would be stronger on 50 than on 144 MHz.

The noise does move by the clock! I have made several recordings of direction and time. In the afternoon, the noise appears from E-SE, at sunset, noise is SE-S. Well after sunset, the disappears in S-SW direction (more than 120° offset from the sun). The only person I have asked, who has noticed the same is OH1ZAA. How about you "Big Guns" over the pond or down under? Maybe something to look for when the band is dead. Perhaps we can work a new one when the ETs get a key! 73 Leif LA9AV

Leif's station is located one hours drive from home. This includes a 15-20 minute hike through the forest, with his TS690S in a backpack! He writes 'I have been doing this for years and especially the last two winters, looking for DX on Six.

I'm retired now, so I go up to the cabin in the early morning with temperatures in the shack of -5°C to +5°C at this time of year, and home again about 17 UTC, with a hand lamp for light as I walk through the forest. Some nights I sleep over, sometimes the batteries are flat and the generator will not start—I'm staying over to listen for the W6s on EME!"

The article brought comments in both the July and October issues of *Six News*, which I am reprinting below:

"In actual fact, the noise noticed originates from our own galactic plane. No reference to 'Big Guns' is needed, as it is strongly received on a dipole! The observed variation is due to the fact that the noise is strongest from the center of the galaxy as more of the sources are collected there.

I have used this source of noise as a free test set up for a very long time now. The reference to compare is that of a resistive termination equal to that of the coax used; i.e., 50Ω or whatever is used. Note the noise when your receiver is looking into a resistive load, then switch to the antenna and measure the difference. Depending on the actual system noise figure; i.e., receiver noise figure plus coaxial cable loss, and frequency, this difference at 6 meters could be 15 dB and at 2 meters about 4 dB when using a dipole.

When using beams aimed at the horizon, this value is generally a bit less and dependent on direction. For us in the northern hemisphere, the galactic center is broadly southerly and, depending on location, time of day, and time of year, is above or below the local horizon. From the southern hemisphere the reverse applies.

The noise comes in from all directions, but there are some hot spots which may be discernible if the beamwidth of your array is small and its elevation is controllable. But, I suspect not many arrays on 6m are big enough to see these, apart from the sun.

Yes this does apply to HF obviously, but as commented upon, so does a whole lot of other noise sources. In fact, the galactic plane noise increases 6 dB per octave.

Above 2m the galactic plane noise dips to below the perfect receiver noise floor, which actually occurs at about 250 MHz and falls off at 6 dB per octave as you go higher. 73 de Mike G3JVL"

"I feel the noise Mike G3JVL discussed in the last *Six News* is not the same as Leif LA9ZV has observed. I feel that Leif is observing the noise produced by the excitation of the E layer. I, and others have noted rises in the general noise level at times when there is a large area of ionized E layer (Sporadic E) just out sight of our antennas for the purpose of reflection (refracting) our signals back to ground, but 'visible' enough to find the area of activity just above the bottom of the layer. This has been observed also on 144 MHz at times.

As Leif says, the noise does not follow the Sun, but is independent. I agree that the increase in noise is small—only 6 dB or so—and therefore is only noticed by stations with a low local noise level—anyone in a town would probably not notice it.

It is a useful guide to the possible approach of a very ionized cloud coming into view with a MUF possibly reaching 144 MHz.

From Leif's point of view, he is only likely to observe this from points south of his QTH due to the decreasing incidence of a highly ionized layer being to the north of him—from our locations in England and further south, the noise can be observed all round the compass.

Leif's observations has borne this out so far. Does anyone else agree, or not, with this conclusion?
73 Ken G4IGO"

The apparent position of a galactic noise source should move about 1° of arc, 4 minutes of time, per day. The shift was quite evident on chart recordings I was making a couple decades ago. Our galaxy extends over the whole sky. Karl Jansky, in the early 1930s, located the primary source of 15m galactic noise at right ascension (R.A.) 18h, declination 10°S in the constellation of Sagittarius. He estimated it to have a radiation temperature of 150,000°K. More recent measurements (1950 epoch) place the galactic center at 17h42m37s R.A. and -28°57' declination.

While the large 50 MHz antenna at Jicamarca was being constructed, scientists there measured the noise level overhead (at 13.3°S) with 1/8th of the final aperture. The noise temperature peaked at about 33,000°K at about 18h20m R.A., in the galactic plane, but not quite at the galactic center. Here are some other points in the plane of our galaxy: 19h +5°, 20h +30°, 21h +46°, 22h +55°, 23h +60°, 00h 62.5°, 01h +63°, 02h +61°, 03h +58.5°, 04h +52°, 05h +41°, 06h +22°, 07h -5.5°, 08h -30.5°, 09h -46°, 10h -55°, 11h -59.7°, 12h -62°, 13h -62.5°, 14h -61.5°, 15h -58.2°, 16h -52.2°, 17h -41.2°, and 18h -22°.

Moonbounce enthusiasts would be advised to steer clear of the galactic plane and especially its center. Hams wishing to measure galactic noise would be advised to steer at it.

From our perspective in the Orion Spur, much of what we see as the Milky Way towards the galactic center is actually the galaxy's Sagittarius Arm. Scientists estimate a loss for visible light of 25 to 30 magnitudes (100-120 dB) between us and the galactic center due to obscuring matter within 2000-3000 parsecs (6-9x10¹⁶ km) of the Sun. This obscuring matter is almost transparent to VHF radio waves, but free electrons there are moving at relativistic velocities in magnetic fields, giving rise to synchrotron radiation. This is a non-thermal; e.g., not black-body radiation. Even though we may ascribe a radiation temperature to the noise source, it doesn't mean the medium is actually at that temperature.

The frequency (in MHz) at which synchrotron radiation peaks is just:

$$f = 6 B E^2$$

where B is the magnetic flux density in gauss and E is the electron energy in Mev. A 1 Gev (1000 Mev) electron in an inter-

stellar magnetic field of 10⁻⁵ gauss would have a frequency of maximum radiation of 60 MHz. For a 1 Gev electron, this radiation is concentrated into a cone with angle 10⁻³ radian about the path of the electron. The idealized spectrum falls off as $f^{-0.7}$ at higher frequencies and only slightly at lower ones. Actual cosmic noise sources have spectra that vary from $f^{-1.0}$ to $f^{2.0}$.

I was about to put Leif's report down as just another report of cosmic noise. His southern horizon is about -31° S declination, allowing ample exposure to the galactic center. But were the times right?

In a future issue, I'll pass along a computer program to compute your azimuth & bearing to any source for which you have declination and R.A. For now, let's consider the sun, since we know where it is. On the vernal equinox, March 21 or so, the sun's apparent Right Ascension is 0h, and increases about 2h per month thereafter. On June 18 it would be at 5h43m, directly opposite the galactic center; e.g., the galactic center would be south at local midnight. The galactic center would be above LA9ZV's horizon for about 3 hours. The galactic nucleus, as far as radio sources is concerned, extends from declination -40° to 0°, and the northerly part would allow longer reception.

Sunset times vary quite a bit with season at 59° latitude. Let's assume that the noise peaked due South at 2000 local time on June 21. The most likely source location is then -13° declination, R.A. 14h, a relatively cool part of the sky. The observed times do correlate with the times the galactic nucleus would be observable during early September, however.

My conclusion is that LA9ZV indeed may have been viewing some other source of 50 MHz noise than the cosmos. I have just received a report from Erik, TI2NA, in which he mentions receiving noise from the South. He says it sounds like charging and discharging, but he says it's not lightning, and he suspects that it is from the equatorial E-layer.

The inner radiation belts descend to the ionosphere east of South America. Could he be observing synchrotron radiation from there? If we put .25 gauss into the above equation, we come up with an electron energy requirement of only 6 Mev. A 6 Mev electron would radiate into a cone of 1/6 radian (about 10°)

Readers desiring more information on the subject may wish to check out **A Portrait of Our Galaxy** in December 1993 *Sky & Telescope*, Section 8-4b of *Radio Astronomy* by John D. Kraus, and *The Milky Way* by Bart J. Bok and Priscilla F. Bok.

March 1993 DX Reports

The following 50 MHz reports of DX heard and worked in Japan are courtesy of JR3HED, and of DX heard and worked in Korea are courtesy of Louis, HL9UH. The year (1993) is understood. The month and the day of the month precede the time, and both have been converted into UTC. The call at the right indicates the reporting station, or if a number(s), the JA call areas reporting the DX. Symbols V = Video carrier, F = FM audio, B = beacon, C = CW, S = SSB.

Africa (& Indian Ocean)

Reunion Island:

03181020 FR5SIX/B	LG78 50.022 B JR6WPT
03181110 FR5SIX/B	LG78 50.022 B JR6WPT
03191117 FR5SIX/B	LG78 50.022 B JR6
0320 849 FR5SIX/B	LG78 50.022 B JR6WPT
0322 945 FR5SIX/B	LG78 50.022 B JR6WPT
03221028 FR5SIX/B	LG78 50.022 B JR6WPT
0323 855 FR5SIX/B	LG78 50.022 B JR6WPT
0323 910 FR5SIX/B	LG78 50.022 B JR6WPT
0324 854 FR5SIX/B	LG78 50.022 B JR6WPT
0326 825 FR5SIX/B	LG78 50.022 B JR6WPT
03261103 FR5SIX/B	LG78 50.022 B JR6
0327 825 FR5SIX/B	LG78 50.022 B JR6WPT
0329 750 FR5SIX/B	LG78 50.022 B JR6WPT
03291105 FR5SIX/B	LG78 50.022 B JR6WPT
0331 853 FR5SIX/B	LG78 50.022 B JR6WPT
04 4 835 FR5SIX/B	LG78 50.022 B 21 6
04 7 903 FR5SIX/B	LG78 50.022 B JR6WPT
04 71030 FR5SIX/B	LG78 50.022 B JR6WPT
04 71100 FR5SIX/B	LG78 50.022 B JR6WPT

Madagascar:

03271148 5R8DP	50.123 C JR6WPT
0328 918 5R8DP	50.123 C JR6WPT
0328 928 5R8DP	50.123 C JR6WPT
0329 810 5R8DP	50.123 C JR6WPT
03301031 5R8DP	50.123 C JR6WPT
03301042 5R8DP	50.123 C JA5GJB/6
03301054 5R8DP	50.123 C JA5GJB/6
03301100 5R8DP	50.123 C 6/JR6
0331 843 5R8DP	50.123 C JR6WPT
04 2 930 5R8DP	50.123 C JR6WPT
04 21030 5R8DP	50.123 C JR6

Malawi:

03 5 940 7Q7CM	50.110 C JR6WPT
03 5 922 7Q7JL	50.110 S JR6WPT
03 81217 7Q7LA	50.110 C JR6
0323 935 7Q7LA	50.110 C JR6WPT
03271150 7Q7LA	50.123 S JR6WPT
03 5 910 7Q7RM	50.110 C JR6WPT
03 81133 7Q7RM	50.110 C JR6
03191106 7Q7RM	50.110 C JR6
0320 837 7Q7RM	50.110 C JR6WPT
0327 950 7Q7RM	50.110 C JR6

Asia

Burma:

03 7 510 XU/JR5KQF	50.110 C 5
03 11305 XU0UN	OK21 50.110 S 5
0313 825 XU0UN	OK21 50.110 S JR6WPT
03221301 XU0UN	OK21 50.115 S JR6WPT
03231230 XU0UN	OK21 50.110 S JR6WPT
03251350 XU0UN	50.1 11 3
04 4 806 XU0UN	OK21 50.110 S JH2GEY
04 4 815 XU0UN	OK21 50.110 S JA7WSZ
04 4 825 XU0UN	OK21 50.110 S All JA
04 4 827 XU0UN	OK21 50.110 S JP2NPG
04 91545 XU0UN	OK21 50.110 S JF1CEQ/JR6
0410 546 XU0UN	OK21 50.110 S JE3GUG
0424 533 XU0UN	OK21 50.112 S JF1CEQ
0424 535 XU0UN	OK21 50.112 S JA7WSZ
0424 538 XU0UN	OK21 50.111 S JH0HQP
0424 539 XU0UN	OK21 50.112 S JP2NPG
0424 604 XU0UN	OK21 50.110 S JA9TLD
0424 610 XU0UN	OK21 50.110 S 11 7/9
0424 640 XU0UN	OK21 50.110 S JH2GEY
04241230 XU0UN	(-2315) 50.1 JR6
03 21300 KUSDX	OK10 50.110 C JR6WPT
03 81300 KUSDX	OK10 50.110 C JR6
0310 438 KUSDX	OK10 50.110 C JH1HHC
0310 438 KUSDX	OK10 50.110 C JP2NPG
0310 452 KUSDX	OK10 50.110 C 1
0310 513 KUSDX	OK10 50.110 S 9
0310 516 KUSDX	OK10 50.110 S JH1HHC
0310 526 KUSDX	OK10 50.110 S 1
03221340 KUSDX	OK10 50.110 S JR6WPT
04 91555 KUSDX	OK10 50.110 C JF1CEQ/JR6

Hong Kong:

03 7 435 VS6BG	OL72 50.110 S JF1CEQ
03 7 440 VS6BG	OL72 50.130 S 1
03 7 400 VS6SIX/B	OL72 50.074 B JA7WSZ
03 7 435 VS6SIX/B	OL72 50.075 B JA4OXY/1
03 7 445 VS6SIX/B	OL72 50.075 B JK1AFU

Japan:

03090908	JR6WPT	559	579	50.110	C	HL9UH
03090910	JR6WPT	5-5both		50.110	S	HL9UH
03090917	JA1CCD	5-4	5-5	50.125	S	HL9UH
03090924	JF4UBC	329	559PM54	50.115	C	HL9UH
03120753	JF3QJR	559	579	50.110	C	HL9UH
03120755	JR3ICR	439	559	50.110	C	HL9UH
03120756	JF3MYA	539	599	50.110	C	HL9UH
03120758	JR3HED	539	599	50.115	C	HL9UH
03120800	JA3QHR	439	599	50.115	C	HL9UH
03120803	JF3QPS	539	599	50.115	C	HL9UH
03120804	JF3QPA	539	559	50.115	C	HL9UH
03120805	JR0MHZ	559both		50.115	C	HL9UH
03120807	JA9BOH			50.115	C	HL9UH
03120808	JR2UAZ			50.115	C	HL9UH
03120809	JF4UCI	429	559	50.115	C	HL9UH
03120811	JF3PCP	429	599	50.115	C	HL9UH
03120814	JF1WCK	559	579	50.115	C	HL9UH
03120819	JR0BQX	559	569	50.115	C	HL9UH
03130820	JF1WTF	429	559	50.115	C	HL9UH
03130822	JG2HPG	559both		50.115	C	HL9UH
03130823	JH7LGT	429	559	50.115	C	HL9UH
03130824	JK1FLX	539	599	50.115	C	HL9UH
03130826	JN3ORX	539	559	50.115	C	HL9UH
03130830	JF3ACL	319	559	50.115	C	HL9UH
03130837	JA3LKY	539	559	50.115	C	HL9UH
03130839	JA9KHU	429	559	50.115	C	HL9UH
03140801	JR2QCV	539	559	50.116	C	HL9UH
03140803	JF4MEE			50.116	C	HL9UH
03140804	JL3SBE			50.116	C	HL9UH
03140805	JR0HQP	559	599	50.116	C	HL9UH
03140806	JF1BJT	429	559	50.116	C	HL9UH
03140807	JF1CKD	539	559	50.116	C	HL9UH
03140808	JR0NWC	559both		50.116	C	HL9UH
03140809	JR1GTG			50.116	C	HL9UH
03140810	JF7REV	539	559	50.116	C	HL9UH
03140811	JH3QNH			50.116	C	HL9UH
03140811	JF2EVL			50.116	C	HL9UH
03140814	JH2GYI	429	559	50.116	C	HL9UH
03140814	JH4JLJ			50.116	C	HL9UH
03140816	JA5EMM			50.116	C	HL9UH
03140817	JR0FEK	539	599	50.116	C	HL9UH
03140818	JF4CMI	539	559	50.116	C	HL9UH
03140819	JF4HFX			50.116	C	HL9UH
03140820	JA0GLM	429	559	50.116	C	HL9UH
03140829	JA6GIL	429	559	50.116	C	HL9UH
03140831	JR3PCP	429	599	50.116	C	HL9UH
03140832	JA5SQH	429	559	50.116	C	HL9UH
03140834	JA2SEK/1	319	559	50.116	C	HL9UH
03140837	JF2XMY	429	529	50.116	C	HL9UH
03140839	JR1CUS	429	519	50.116	C	HL9UH
03140841	JF3PID	429	539	50.116	C	HL9UH
03140939	JR1BMJ	539	579 QM05	50.106	C	HL9UH
03150747	JA4QHO			50.110	C	HL9UH
03150807	JF3EVZ	319	519	50.116	C	HL9UH
03240823	JF2UHR	559both		50.115	C	HL9UH
03240825	JA4OEY/1	439	559	50.115	C	HL9UH
03240826	JA3UWR	549	599	50.115	C	HL9UH
03240826	JL1IHE	429	599	50.115	C	HL9UH
03240830	JCCPE	539	559	50.115	C	HL9UH
03240830	JK1AIA	559	599	50.115	C	HL9UH
03240832	JA0LSQ	539	559	50.115	C	HL9UH
03240832	JA8RC	559	599	50.115	C	HL9UH
03240833	JA4BXL	559	599	50.115	C	HL9UH
03240834	JF2WUI	539	559	50.115	C	HL9UH
03240835	JCJRC	559	599	50.115	C	HL9UH
03240836	JK4USZ	559	599	50.115	C	HL9UH
03240836	JO2EZH	539	559	50.115	C	HL9UH
03240838	JF3PFP	539	569	50.115	C	HL9UH
03240839	JR4QBO	559/79	599	50.115	C	HL9UH
03240841	JH1BSJ	539	559	50.115	C	HL9UH
03240842	JF1WJC	539	579	50.115	C	HL9UH
03240843	JK1FFB	429	559	50.115	C	HL9UH
03240845	JCMVK	529	559	50.115	C	HL9UH
03240846	JA2AUE	429	539	50.115	C	HL9UH
03240847	JF1FVH	559	579	50.115	C	HL9UH
03240848	JCSKE	539	559 PM95	50.115	C	HL9UH
03240849	JF1MEQ	429	559	50.115	C	HL9UH
03240851	JG1FIC	549	559	50.115	C	HL9UH
03240852	JF1BMN	549	559	50.115	C	HL9UH
03240853	JL1RLR	559	579	50.115	C	HL9UH
03240854	JF1LOWT	429	549	50.115	C	HL9UH
03240856	JG3LLF/1	429	559	50.115	C	HL9UH
03240859	JR3RMA	429	599	50.115	C	HL9UH
03240900	JCHBP	429	559	50.115	C	HL9UH
03240902	JF3LGP	429	559	50.115	C	HL9UH
03240903	JF1RRK	429	559	50.115	C	HL9UH
03250904	JCFHX	429	599	50.115	C	HL9UH
03250905	JA9BHZ	42/539	599	50.115	C	HL9UH
03250905	JM6HOR	429	579	50.115	C	HL9UH
03250907	JO1DFG/9	429	559	50.115	C	HL9UH
03250909	JG2GBZ	429	559 PM85	50.115	C	HL9UH
03250910	JCKYM	429	559	50.115	C	HL9UH
03250911	JG2QEH	429	559	50.115	C	HL9UH
03250912	JR0HQP	559	599	50.115	C	HL9UH
03250913	JR0HWC	559	599	50.115	C	HL9UH
03270750	JR0BAQ	319	559	50.115	C	HL9UH
03270802	JF2SEK/1	319	539	50.102	C	HL9UH

Korea, South:

03	7 815	HL9UH	50.115	S	JA7WSZ
03	8 914	HL9UH	50.125	S	1
0313	806	HL9UH	50.115	S	JH1HHC
0313	745	HL9UH	50.110	C	2/3
0313	820	HL9UH	50.115	C	JR0BQX
0313	830	HL9UH	50.110	C	01 6/9
0314	803	HL9UH	50.116	C	JA9TLD
0314	805	HL9UH	50.116	C	JH2GEY
0314	807	HL9UH	50.116	C	JR0BQX
0314	830	HL9UH	50.110	C	01 6/9
0314	853	HL9UH	50.130	S	JR0BQX
0314	909	HL9UH	50.110	S	JA7WSZ
0314	910	HL9UH	50.110	S	JF3GUG
0315	800	HL9UH	50.115	C	JK1AFU
0324	907	HL9UH	50.115	C	9

0325	824	HL9UH	50.115	C	JA4OEY/1
0325	825	HL9UH	50.115	C	JP2NPG
0325	830	HL9UH	50.110	C	JA0LSQ
0325	844	HL9UH	50.115	C	JA7WSZ
0325	853	HL9UH	50.115	C	JR0BQX
0327	733	HL9UH	50.110	C	JR0BQX
0327	735	HL9UH	50.110	C	JA7WSZ
0327	740	HL9UH	50.115	C	JA9TLD
04	4 833	HL9UH	50.110	C	JA9TLD
04	4 955	HL9UH	50.110	C	3
04	8 809	HL9UH	50.110	C	JP2NPG
04	8 830	HL9UH	50.110	C	11 3
0411	436	HL9UH	50.115	S	JE3GUG

Taiwan:

0314	755	BV2DP	50.111	C	JA9TLD
0314	825	BV2DP	50.110	C	11 3
0322	950	BV2DP	50.110	C	JR6WPT
0323	950	BV2DP	50.110	C	JR6WPT
0324	738	BV2DP	50.110	C	9
0325	750	BV2DP	50.110	C	JA4OEY/1

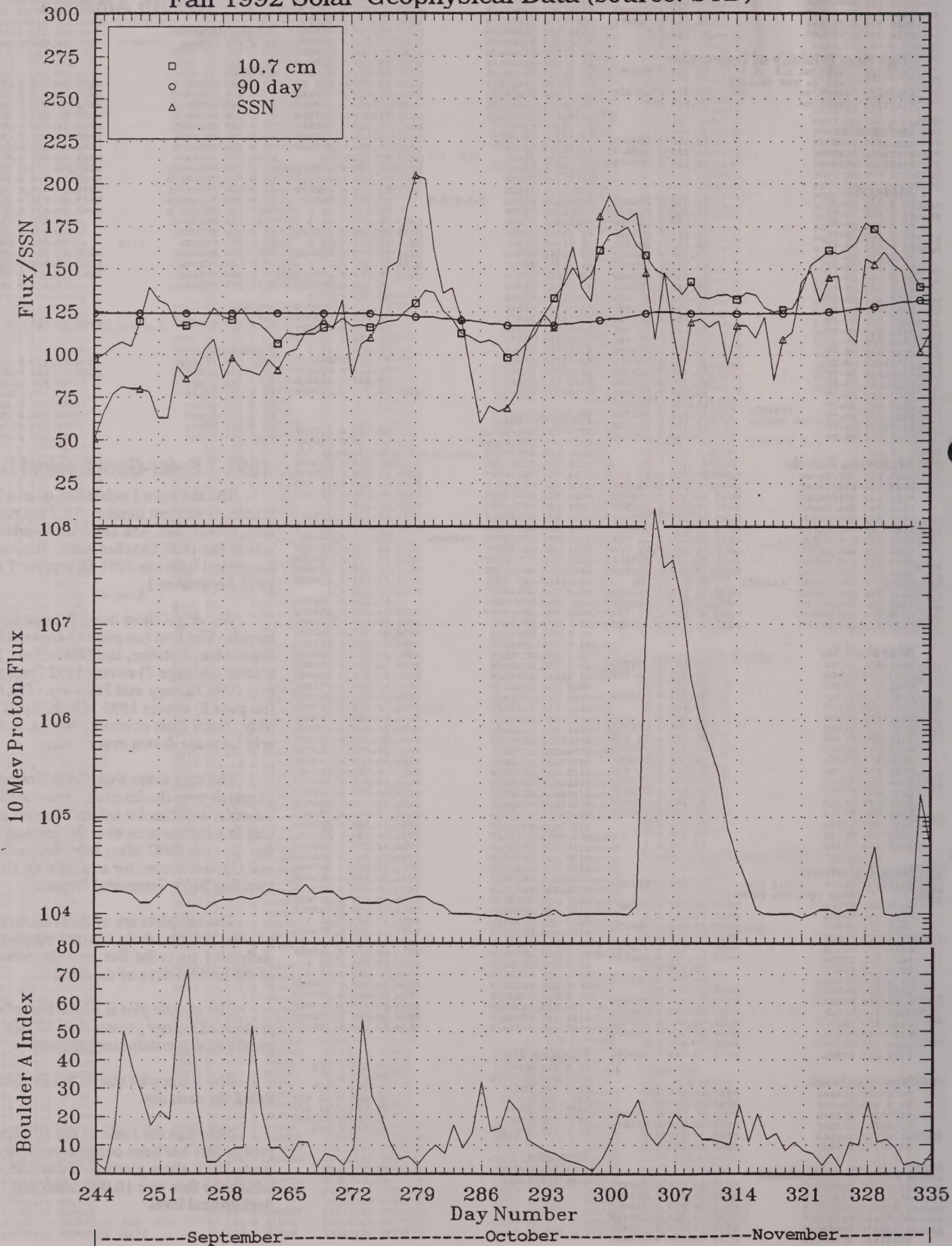
Australia:

0327	633	ABMN-0	50.111	C	JA9TLD
03	2 900	VK-TVQ0	50.110	C	11 3
03	2 900	VK-TVQ0	50.110	C	JR6WPT
03	3 930	VK-TVQ0	50.110	C	JR6WPT
03	5 100	VK-TVQ0	50.110	C	9
0312	755	VK-TVQ0	50.110	C	JA4OEY/1
0314	135	VK-TVQ0	50.110	C	9
0315	930	VK-TVQ0	50.110	C	JA4OEY/1
0321	200	VQ-0	50.110	C	JA4OEY/1
0323	930	VQ-0	50.110	C	JA4OEY/1
0327	633	VQ-0	50.110	C	JA4OEY/1
0328	435	VQ-0	50.110	C	JA4OEY/1
03141230	VK1BFP		50.110	C	HL9UH
03141135	VK1VP		50.120	S	5
03	5 557	VK2EJE	50.110	C	JA8RC
0322	343	VK2GL	50.110	C	JF1CQ
03	7 321	VK2QF	50.110	C	JA7WSZ
03	7 326	VK2QF	50.110	C	JA7WSZ
03	7 327	VK2QF	50.110	C	JA9TLD
03141130	VK2QF		50.110	C	5
03141130	VK2QF		50.110	C	JE3GUG
03141135	VK2QF		50.110	C	JH2GEY
0322	349	VK2QF	50.106	C	JF1CQ
0322	400	VK2QF	50.110	C	JF1CQ
04	7 314	VK2QF	50.101	C	JH1WHS
0411	445	VK2QF	50.106	C	JA9TLD
03	7 530	VK2UN	50.135	S	JK1AFU
03	7 518	VK2UNE	50.135	S	7
03	7 524	VK2UNE	50.135	S	7
0327	632	VK2NPL	50.110	C	JA7WSZ
03	7 814	VK2YDC	50.115	C	JA7WSZ
03070813	VK2YDC		50.115	C	HL9UH
03	7 345	VK3OT	50.110	C	JA7WSZ
03	7 345	VK3OT	50.105	C	9
03	7 641	VK3OT	50.110	C	JR0BQX
03	7 647	VK3OT	50.150	C	JA0LSQ
03	7 655	VK3OT	50.110	C	JA9TLD
0310	459	VK3OT	50.110	C	1
03151032	VK4ABF/B		52.345	B	JA7WSZ
03	7 345	VK4ABW	50.110	C	JA0LSQ
03	7 346	VK4ABW	50.110	C	JA7WSZ
03	7 350	VK4ABW	50.120	S	JF1CQ
03	7 356	VK4ABW	50.120	S	JR0BQX
03070831	VK4ABW		50.115	C	HL9UH
03151222	VK4ABW		50.110	C	JA7WSZ
03211307	VK4ABW		50.110	C	JA0LSQ
0327	733	VK4ABW	50.110	C	JR0BQX
03270730	VK4ABW		50.110	C	HL9UH
04	4 955	VK4ABW	50.110	C	3
04	41025	VK4ABW	50.110	C	JH6MPE
04	41102	VK4ABW	50.150	S	JH1WHS
04	7 350	VK4ABW	50.150	S	11 3
04	7 430	VK4ABW	50.120	S	All JA
03070840	VK4ABL		50.145	S	JK1AFU
032	3 337	VK4ABL	50.115	C	HL9UH
03	2 934	VK4APL	50.150	S	1
03	2 944	VK4APL	50.155	S	JA7WSZ
03	5 608	VK4APL	50.120	S	JA8RC
03	7 535	VK4APL	50.165	S	JR0BQX
04	2 842	VK4APL	50.130	S	JA7WSZ
04	31020	VK4APL	50.150	S	JA7WSZ
04	7 446	VK4APL	50.145	S	All JA
04	7 446	VK4APL	50.145	S	JH1WHS
0411	422	VK4APL	50.145	S	JH1WHS
0411	437	VK4APL	50.115	C	JR0BQX
03	2 930	VK4ALM	50.125	S	JE3GUG
03	3 922	VK4ALM	50.170	S	JA7WSZ
03	7 443	VK4ALM	50.110	S	JE3G

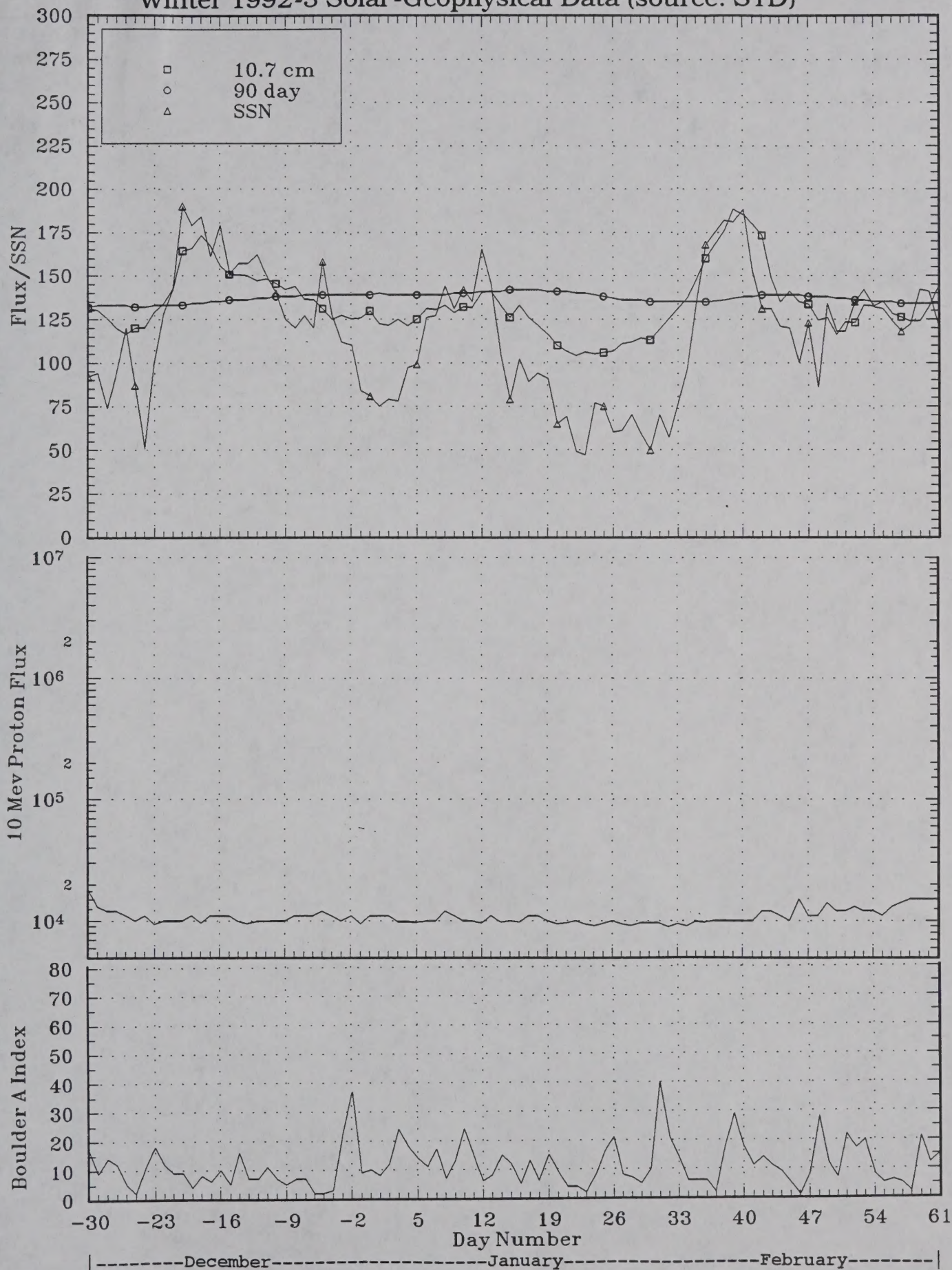
03 21108 VK4IAM	QG64	50.120 S	JE3GUG	03 2 940 VK4WTH	50.130 S	JE3GUG	03221212 VK8VF/B	PH57 50.057 B	JH2GEY		
03 21108 VK4IAM	QG64	50.120 S	JH0BQX	03 7 655 VK4WTH	50. C	JA9TLD	03221238 VK8VF/B	PH57 50.057 B	JA9TLD		
03070818 VK4IAM/m	5-4 5-9	50.115 S	HL9UH	0310 556 VK4WTH	50.110 S	1	03231145 VK8VF/B	PH57 50.057 B	JE3GUG		
0314 232 VK4IAM	5-9both	50.110 S	JF1CEQ	0310 739 VK4WTH	50.099 C	JP2NPG	03231151 VK8VF/B	PH57 50.057 B	JA9TLD		
03140750 VK4IAM	50.105 S	HL9UH	0314 412 VK4WTH	0314 412 VK4WTH	50.130 S	JH2GEY	03231255 VK8VF/B	PH57 50.057 B	JR6WPT		
0320 323 VK4IAM	QG64	50.125 S	JA9TLD	0320 322 VK4WTH	50.110 S	JA9TLD	03251058 VK8VF/B	PH57 50.057 B	JH0BQX		
0320 330 VK4IAM	QG64	50.125 S	JF1CEQ	0320 336 VK4WTH	50.110 S	JF1CEQ	03251150 VK8VF/B	PH57 50.057 B	JE3GUG		
0325 805 VK4IAM	QG64	50.110 S	JA4OEY/1	0411 437 VK4WTH	50.115 S	JH0BQX	03251333 VK8VF/B	PH57 50.057 B	JA9TLD		
0325 808 VK4IAM	QG64	50.120 S	JP2NPG	03 21050 VK4XA	QG62	50.130 C	JA9TLD	03271115 VK8VF/B	PH57 50.057 B	JA9TLD	
04 3 930 VK4IAM	QG64	50.120 S	JH6MPE	03 5 233 VK4XA	QG62	50.100 C	JA8RC	03301117 VK8VF/B	PH57 50.057 B	JA9TLD	
04 3 942 VK4IAM	QG64	50.120 S	JH1WHS	03 5 331 VK4XA	QG62	50.099 C	JP2NPG	0331 945 VK8VF/B	PH57 50.057 B	JA7WSZ	
04 3 948 VK4IAM	QG64	50.120 S	JA9TLD	03 7 536 VK4XA	QG62	50.099 C	JH0BQX	03311021 VK8VF/B	PH57 50.057 B	1/2	
0411 348 VK4IAM	QG64	50.110 S	JE3GUG	03 7 831 VK4XA	QG62	50.099 C	JA7WSZ	03311033 VK8VF/B	PH57 50.057 B	JP2NPG	
0411 347 VK4IDM	50.110 S	JA9TLD	03 9 202 VK4XA	0320 343 VK4XA	QG62	50.100 C	JA8RC	04 11014 VK8VF/B	PH57 50.057 B	JP2NPG	
0320 858 VK4IJ	50.125 S	JA9TLD	0320 343 VK4XA	03240857 VK4XA	QG62	50.099 C	JF1CEQ	04 21140 VK8VF/B	PH57 50.057 B	JA7WSZ	
0310 730 VK4IT	50.1	1	03240857 VK4XA	539 579	50.115 C	HL9UH	04 21218 VK8VF/B	PH57 50.057 B	JP2NPG		
03 21116 VK4JH	QH30	50.110 C	JH0BQX	0325 850 VK4XA	50.099 C	JP2NPG	04 31053 VK8VF/B	PH57 50.057 B	JA7WSZ		
03 3 944 VK4JH	QH30	50.130 S	JE3GUG	0327 817 VK4YPM	50.110 S	JA9TLD	04 31110 VK8VF/B	PH57 50.057 B	JA9TLD		
03 31017 VK4JH	QH30	50.130 S	JP2NPG	03 7 500 VK4ZAL	50.1 S	JK1AFU	04 31117 VK8VF/B	PH57 50.057 B	JP2NPG		
03 7 553 VK4JH	QH30	50.150 S	JP2NPG	03 7 502 VK4ZAL	50.110 S	JE3GUG	04 41047 VK8VF/B	PH57 50.057 B	1/2		
0312 819 VK4JH	QH30	50.110 C	JE3GUG	03 7 503 VK4ZAL	50.110 S	JH0BQX	04 41051 VK8VF/B	PH57 50.057 B	JA7WSZ		
0312 836 VK4JH	QH30	50.150 S	JA7WSZ	03 7 505 VK4ZAL	50.110 S	JA9TLD	04 41053 VK8VF/B	PH57 50.057 B	JH6MPE		
0312 902 VK4JH	QH30	50.150 S	JP2NPG	03 7 521 VK4ZAL	50.140 S	JR0QFA	04 41100 VK8VF/B	PH57 50.057 B	11 3		
03120500 VK4JH	50.1	1	HL9UH	0310 730 VK4ZAL	50.1	1	04 41135 VK8VF/B	PH57 50.057 B	JA9TLD		
0315 953 VK4JH	QH30	50.110 C	JE3GUG	0310 800 VK4ZAL	50.110 S	JP2NPG	04 41155 VK8VF/B	PH57 50.057 B	JA9TLD		
03151258 VK4JH	QH30	50.110 S	JA9TLD	0325 858 VK4ZAL	50.183 S	JH0BQX	04 61126 VK8VF/B	PH57 50.057 B	JA7WSZ		
03 2 937 VK4KK	QG62	50.110 C	JE3GUG	04 7 416 VK4ZAL	50.145 S	ALL JA	04 71244 VK8VF/B	PH57 50.057 B	JP2NPG		
03 7 915 VK4KK	QG62	50.105 S	JH0BQX	0411 442 VK4ZAL	50.150 S	JH0BQX	04111053 VK8VF/B	PH57 50.057 B	JA9TLD		
0310 730 VK4KK	50.1	1	0411 442 VK4ZAL	0411 442 VK4ZAL	50.150 S	JH2GEY	04111105 VK8VF/B	PH57 50.057 B	JH6MPE		
03151156 VK4KK	QG62	50.105 C	JA9TLD	0411 444 VK4ZAL	50.110 S	JA9TLD	04111036 VK8VF/B	PH57 50.057 B	JA7WSZ		
03151214 VK4KK	QG62	50.106 C	JA7WSZ	0411 455 VK4ZAL	50.110 S	JH1WHS	04111107 VK8VF/B	PH57 50.057 B	JA9TLD		
03200401 VK4KK	3-2/5-4 5-9	50.110 S	HL9UH	0412 422 VK4ZAL	50.130 S	JH1WHS	0423 954 VK8VF/B	PH57 50.057 B	JP2NPG		
0327 257 VK4KK	QG62	50.110 S	JA7WSZ	03 7 818 VK4ZAR	50.110 S	JH0BQX	0423 957 VK8VF/B	PH57 50.057 B	JA9TLD		
04 7 400 VK4KK	QG62	50.110 S	ALL JA	03 7 819 VK4ZAR	50.120 S	JA7WSZ	04241155 VK8VF/B	PH57 50.057 B	JA9TLD		
04 7 413 VK4KK	QG62	50.130 S	ALL JA	03070814 VK4ZAR	50.115 S	HL9UH	04241046 VK8VF/B	PH57 50.057 B	JA9TLD		
0411 945 VK4KK	QG62	50.110 C	JA7WSZ	03 2 938 VK4ZAZ	QG63	50.110 S	JA7WSZ	04291020 VK8VF/B	PH57 50.057 B	JE3GUG	
0424 340 VK4KK	QG62	50.110 S	JA9TLD	03 3 919 VK4ZAZ	QG63	50.110 S	JA7WSZ	04291107 VK8VF/B	PH57 50.057 B	JA9TLD	
0424 340 VK4KK	QG62	50.110 S	JH0BQX	03 5 257 VK4ZAZ	QG63	50.130 S	JA8RC	04301044 VK8VF/B	PH57 50.057 B	JA9TLD	
03 5 241 VK4KU	50.130 S	JA8RC	03 5 325 VK4ZAZ	03 5 325 VK4ZAZ	QG63	50.110 S	JP2NPG	03251310 VK8VB	50.120 S	JA5GJH/6	
03 5 536 VK4KU	50.109 S	JA8RC	03 7 323 VK4ZAZ	03 7 323 VK4ZAZ	QG63	50.110 S	JA7WSZ	03 5 357 VK8STM	50.165 S	JE3GUG	
0325 852 VK4NE	50.140 S	JP2NPG	03 7 324 VK4ZAZ	03 7 324 VK4ZAZ	QG63	50.120 S	JA9TLD	03 7 331 VK8STM	50.132 S	JA9TLD	
0325 854 VK4NE	50.140 S	JH0BQX	03 7 438 VK4ZAZ	03 7 438 VK4ZAZ	QG63	50.110 S	JH0BQX	03 7 335 VK8STM	50.150 S	JA7WSZ	
03 5 350 VK4PG	50.140 S	JA8RC	03 7 518 VK4ZAZ	03 7 518 VK4ZAZ	QG63	50.1 S	JK1AFU	03070825 VK8STM	3-1/5-2 5-8	50.110 S	HL9UH
03 7 320 VK4PU	50.120 S	JA7WSZ	03070811 VK4ZAZ	5-5/7both	50.110 S	HL9UH	03 7 907 VK8STM	0424 410 VK8STM	50.125 S	JH0BQX	
03 2 835 VK4PU	QG63	50.100 C	7M1BQT	04 7 415 VK4ZAZ	50.145 S	JH1WHS	03 7 930 VK8STM	0424 439 VK8STM	50.118 S	JH0BQX	
03 2 856 VK4PU	QG63	50.130 S	JA7WSZ	0411 500 VK4ZDK	50.105 S	JH1WHS	0424 439 VK8STM		50.117 S	JA9TLD	
03 5 235 VK4PU	QG63	50.130 S	JA8RC	0327 918 VK4ZJR	QG63	50.158 S	JP2NPG				
03 5 250 VK4PU	QG63	50.105 C	JA4OEY/1	04 31115 VK4ZJR	QG63	50.190 S	JF1CEQ				
03 5 342 VK4PU	QG63	50.155 S	JP2NPG	0411 350 VK4ZJR	QG63	50.190 S	JA9TLD				
03 7 401 VK4PU	QG63	50.140 S	JH0BQX	0411 356 VK4ZJR	QG63	50.110 S	JA5GJH/6				
03 7 403 VK4PU	QG63	50.140 S	JA7WSZ	0411 445 VK4ZJR	QG63	50.130 S	JA9TLD				
03 7 418 VK4PU	QG63	50.140 S	JP2NPG	0411 453 VK4ZJR	QG63	50.125 S	JH1WHS				
03 8 545 VK4PU	QG63	50.105 C	7	04111035 VK4ZJR	QG63	50.120 S	JA9TLD				
0314 235 VK4PU	QG63	50.176 C	JA4OEY/1	04111104 VK4ZJR	QG63	50.178 S	JP2NPG				
0314 745 VK4PU	QG63	50.105 S	01 7/9	0428 935 VK4ZJR	QG63	50.140 S	JH0BQX				
03140745 VK4PU	5-9both	50.105 S	HL9UH	0411 455 VK4ZK	QG63	50.140 S	JA7WSZ				
03151028 VK4PU	QG63	50.176 S	JP2NPG	0327 637 VK6JG	QG63	50.130 S	JA9TLD				
03151147 VK4PU	QG63	50.100 C	JA9TLD	0410 630 VK6JG	QG63	50.105 C	JA9TLD				
03151157 VK4PU	QG63	50.120 C	JA5GJH/6	0429 609 VK6JG	QG63	50.110 C	JA9TLD				
0318 745 VK4PU	QG63	50.105 S	1	0429 701 VK6JG	QG63	50.110 C	JE3GUG				
0320 428 VK4PU	QG63	50.120 S	JF1CEQ	03 11045 VK6JG	QG63	50.114 C	5				
0320 436 VK4PU	QG63	50.110 S	JP2NPG	03 11153 VK6JG	QG63	50.110 S	JA9TLD				
0320 509 VK4PU	QG63	50.120 S	JH0BQX	03 51011 VK6JG	QG63	50.115 C	JA9TLD				
0322 351 VK4PU	QG63	50.105 C	JF1CEQ	03 51135 VK6JG	QG63	50.108 C	JE3GUG				
0411 437 VK4PU	QG63	50.120 S	JH0BQX	03 71200 VK6JG	QG63	50.110 C	JR6WPT				
0411 444 VK4PU	QG63	50.105 C	JA9TLD	0310 529 VK6JG	QG63	50.105 C	1				
0411 454 VK4PU	QG63	50.101 C	JH0BQX	03111143 VK6JG	QG63	50.100 C	JA9TLD				
0411 507 VK4PU	QG63	50.101 C	JP2NPG	03111145 VK6JG	QG63	50.120 S	JA5GJH/6				
0318 343 VK4RO	QH30	50.110 S	JH0BQX	03141025 VK6JG	QG63	50.102 C	JA9TLD				
03151032 VK4RTL/B	QH30	50.110 S	JE3GUG	03141158 VK6JG	QG63	50.103 C	JP2NPG				
0328 442 VK4RTL/B	QH30	50.110 S	JE3GUG	03141207 VK6JG	QG63	50.115 C	JR6WPT				
0411 443 VK4RTL/B	QH30	50.110 S	JE3GUG	03211008 VK6JG	QG63	50.114 C	7				
0411 456 VK4RTL/B	QH30	50.110 S	JE3GUG	0327 548 VK6JG	QG63	50.116 C	JA4OEY/1				
03151118 VK4SIX	PG59	50.150 S	JA9TLD	0327 637 VK6JG	QG63	50.115 C	JA9TLD				
03151133 VK4SIX	QH32	50.110 C	JR6WPT	03271143 VK6JG	QG63	50.117 C	JA7WSZ				
0314 800 VK4TL	QH32	50.110 C	JF1CEQ	04 2 954 VK6JG	QG63	50.115 C	JP2NPG				
03141151 VK4TL	QH32	50.145 C	JA9TLD	04 21216 VK6JG	QG63	50.115 C	JA4OEY/1				
03141159 VK4TL	QH32	50.145 C	JP2NPG	04 21220 VK6JG	QG63	50.115 C	JP2NPG				
03141200 VK4TL	QH32	50.110 S	JE3GUG	04 31328 VK6JG	QG63	50.111 C	JA9TLD				
03151025 VK4TL	QH32	50.155 S	JP2NPG	04 41200 VK6JG	QG63	50.118 C	JF1CEQ				
0329 902 VK4TL	QH32	50.150 S	JH1WHS	04 81024 VK6JG	QG63	50.120 C	JH0BQX				
04 31040 VK4TL	QH32	50.110 S	JA7WSZ	04111105 VK6JG	QG63	50.115 C	JA9TLD				
04 31116 VK4TL	QH32	50.110 S	JP2NPG	0414 959 VK6JG	QG63	50.115 C	JP2NPG				
04 31121 VK4TL	QH32	50.145 S	JH1WHS	0423 954 VK6JG	QG63	50.115 C	JA9TLD				
04 7 329 VK4TL	QH32	50.125 S	JH1WHS	04241153 VK6JG	QG63	50.116 C	JA9TLD				
0411 533 VK4TL	QH32	50.125 S	JA9TLD	0428 955 VK6JG	QG63	50.105 C	JP2NPG				
04111105 VK4TL	QH32	50.125 S	JH1WHS	04281006 VK6JG	QG63	50.110 C	JA7WSZ				
04111107 VK4TL	50.130 S	1	0429 552 VK6JG	0429 552 VK6JG	QG63	50.116 C	JA9TLD				
03 7 544 VK4TON	QF49	50.135 S	JH0ISW	03 7 431 VK6YCF	QG63	50.110 S	7				
03 7 541 VK4UW	QG63	50.130 S	JP2NPG	03 7 433 VK6YCF	QG63	50.140 S	JE3GUG				
0312006 VK4UTT	QG63	50.130 S	JE3GUG	03 7 443 VK6YCF	QG63	50.140 S	JH2GEY				
0312008 VK4UTT	50.1 S	JK1AFU	03 7 444 VK6YCF	03 7 444 VK6YCF	QG63	50.140 S	JH0BQX				
03 7 500 VK4UTT	QG63	50.130 S	JA9TLD	03151230 VK6YCF	QG63	50.110 S	JR6WPT				
03 7 505 VK4UTT	QG63	50.154 S	JP2NPG	0327 638 VK6YJ	QG63	50.121 C	JA7WSZ				
0314 244 VK4UTT	QG63	50.160 S	JA9TLD	0327 646 VK6EJD	QG63	50.130 S	JA7WSZ				
0314 253 VK4UTT	QG63	50.135 S	JA9TLD	0410 631 VK6EJD	QG63	50.110 S	JA9TLD				
0320 332 VK4UTT	QG63	50.135 S	JF1CEQ	04191102 VK8AH	PH57	50.111 C	JH6MPE				
0320 336 VK4UTT	QG63	50.130 S	JH0BQX	04191227 VK8AH	PH57	50.110 C	JA9TLD				
0320 527 VK4UTT	QG63	50.110 S	HL9UH	04131031 VK8RH	PH57	50.110 C	JH6MPE				
03200951 VK4UTT	5-3 5-6	50.180 S	JP2NPG	04131039 VK8RH	50.110 C	11 7					
0325 842 VK4UTT	50.115 S	JA9TLD	04131106 VK8RH	04131106 VK8RH	50.110 C	JA7WSZ					
04 41134 VK4VV	50.115 S	JP2NPG	04241202 VK8RH	04241202 VK8RH	50.110 C	JA9TLD					

5

Fall 1992 Solar-Geophysical Data (source: STD)



Winter 1992-3 Solar-Geophysical Data (source: STD)



Spring 1993 Solar-Geophysical Data (source: STD)

